

Ice Sheet System Model: short and long term challenges.

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Theme: Improved Thermal Modeling of Ice Sheets

Field Campaign: Greenland (UCI/ETH):

- ice coring to recover vertical thermal profiles (0-800m)

Model Development (JPL):

- Improve thermal model in ISSMc(20% of dvpt effort):
 - Energy-based formulation
 - Temperate ice
 - Evaluate thermal model with in-situ observations.
- Develop adjoint of thermal model to allow data assimilation of ice core measurements (80% of dvpt effort):
 - Physics-based adjoint (currently implemented)
 - Code-driven adjoint (technology to be developed) (80% of dvpt effort)

Model Analysis (JPL):

- Thermal projection of the Greenland Ice Sheet for next 20 years.
- Improved confidence bounds on thermal projections.
- Establishment of an optimized framework for improved sea level projections that employs massive data assimilation.

Theme: Improved Sea-Level Rise Projections

Beyond improved thermal model and analysis:

Field Campaign (UCI):

Ice-ocean interaction

- CTD buoys (melting rates, run-off)
- Sill depth and sediment layer depth

Model Development (JPL):

- Incorporate new physics and capabilities in ISSM (60% dvpt effort)
 - Tidal deformation (visco-elastic law)
 - Calving dynamics (moving boundaries)
 - Grounding line dynamics
 - Rift propagation and fracture damage
 - Post-glacial rebound
- Data driven thermo-mechanical simulations in ISSM (20% dvpt effort)
 - Extend auto-differentiation
 - Mechanical
 - Hydrological
 - Transient
- Ice-ocean full coupling (ISSM-MITgcm) (20% dvpt effort)

5-10 Year Initiative [\$1.8M x3: JPL/ UCI]

Modeling Analysis (JPL):

- Continental scale projections for Greenland and Antarctic ice sheets next 100 years
- Improved confidence bounds of projections
- Error analysis

Thanks!

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